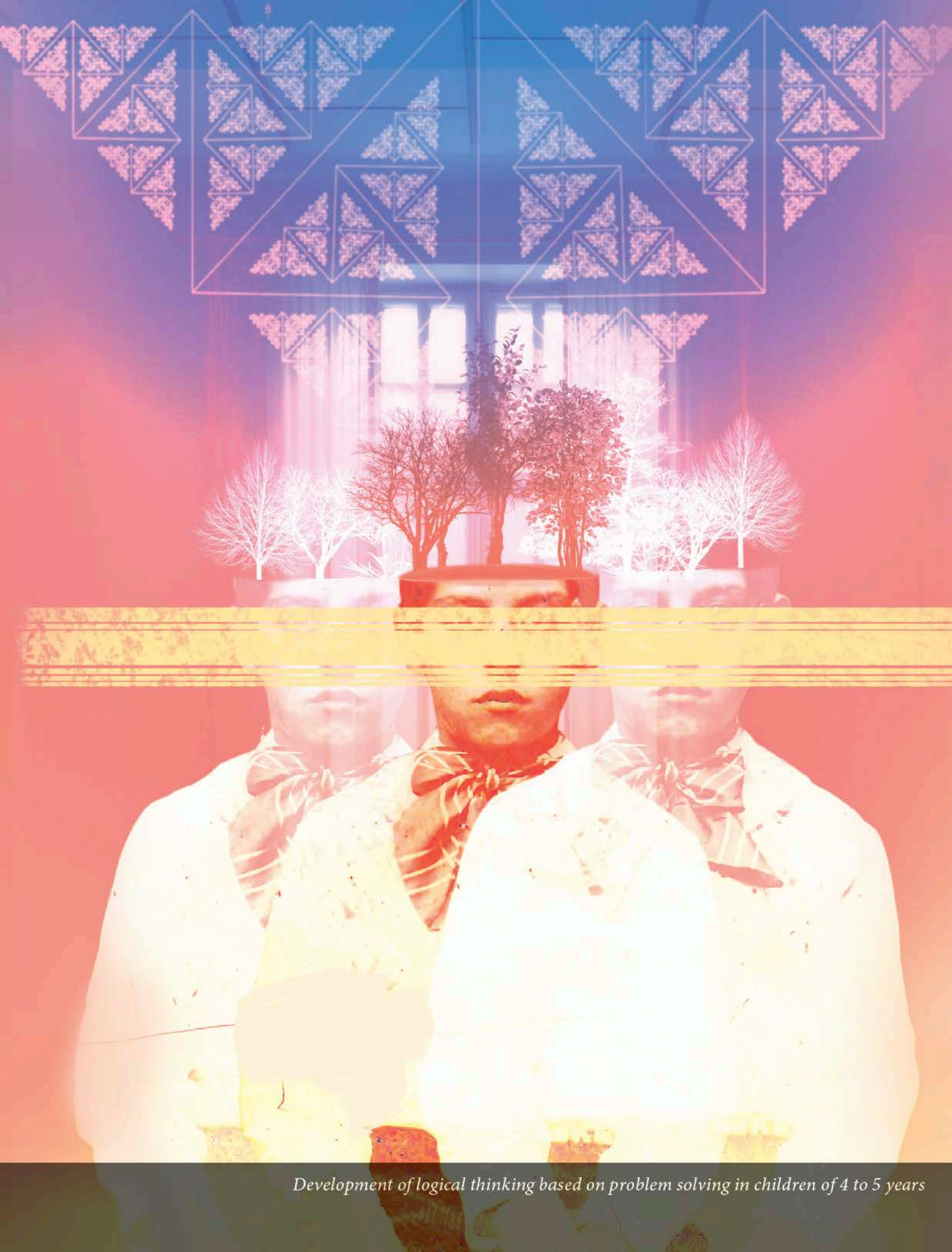

Development of logical thinking based on problem solving in children of 4 to 5 years

DEVELOPMENT OF LOGICAL THINKING BASED ON PROBLEM SOLVING IN CHILDREN OF 4 TO 5 YEARS

Desarrollo del pensamiento lógico basado en resolución de problemas en niños de 4 a 5 años

Desenvolvimento do pensamento lógico baseado em resolução de problemas em crianças de 4 a 5 anos

RECIBIDO: 11 DE ABRIL DE 2016 EVALUADO: 19 DE AGOSTO DE 2016 APROBADO: 30 DE AGOSTO DE 2016

Ana Patricia León Urquijo (Colombia)
apleonurquijo@hotmail.com
Corporación Universitaria Minuto de Dios
Doctora en Filosofía y Ciencias de la Educación

Jacqueline del Carmen Casas Antilef (Chile)
Jakelin.casas@gmail.com
Universidad de los Lagos
Magister en Ciencias de la Educación

Gerardo Restrepo Ramírez (Colombia)
Gerardo.Restrepo@USherbrooke.ca
Profesor Universidad de Sherbrooke
Doctor en Educación

en

ABSTRACT

We present the results of the descriptive longitudinal panel "Development of mathematical logical thinking based on problem solving in children aged 4 to 5 years" from a public educational institution in Osorno, Chile. It was carried out through an educational intervention program based on problems during 2013-2014, using didactic strategy of practical life through play, with the purpose of analyzing the processes of the development of logical thinking. The instrument used was the "Scale to Observe Strategies for Problem Solving" by Sáiz y Román (2011). In addition, field notes were registered. In this paper, we present the results of attention, understanding and motivation items. Some children were found to be resourceful for solving problem situations, while others imitate, ask for help, and resolve them with the repetition of the instructions; some need concrete support with suggestions, and very few do not try or aim to resolve them. It was concluded that the development of the thought is propitiated in a social environment where the educator plays an important role contributing to the interaction of children making use of effective communication and mutual support.

es

RESUMEN

Se presenta los resultados de la investigación descriptiva longitudinal panel "Desarrollo del pensamiento lógico matemático basado en resolución de problema en niños y niñas de 4 a 5 años" de una institución educativa pública de Osorno, Chile, que se realizó mediante un programa de intervención educativa basada en problemas durante 2013-2014, utilizando estrategia didáctica de la vida práctica a través del juego, con el propósito de analizar los procesos del desarrollo del pensamiento lógico. El instrumento fue la "Escala para Observar Estrategias de Resolución de Problemas" de Sáiz y Román (2011). Además se hizo el registro de notas de campo. En este artículo se presentan los resultados de los ítems de atención comprensión y motivación. Se encontró que algunos niños son ingeniosos buscando recursos para resolución de situaciones problemas, otros imitan, piden ayuda y resuelven con la repetición de instrucciones; algunos necesitan apoyo concreto con sugerencias y muy pocos no se esfuerzan ni intentan hacerlo. Se concluyó que el desarrollo del pensamiento se propicia en un ambiente social donde la educadora juega un papel importante contribuyendo a la

por

RESUMO

Se apresenta os resultados da pesquisa descritiva longitudinal painel "Desenvolvimento do pensamento lógico matemático baseado em resolução de problema em meninos e meninas de 4 a 5 anos" de uma instituição educativa pública de Osorno, Chile, que se realizou mediante um programa de intervenção educativa baseada em problemas durante 2013 -2014, utilizando estratégia didática da vida prática através do jogo, com o propósito de analizar os processos do desenvolvimento do pensamento lógico. O instrumento foi a "Escala para Observar Estratégias de Resolução de Problemas" de Sáiz e Román (2011). Além disso fez-se o registro de notas de campo. Em este artigo se apresentam os resultados dos itens de atenção compreensão e motivação. Encontrou-se que alguns meninos são engenhosos procurando recursos para resolução de situações problemas, outros imitam, pedem ajuda e resolvem com a repetição de instruções; alguns necessitam apoio concreto com sugestões e muito poucos não se esforçam nem intentam fazê-lo. Concluiu-se que o desenvolvimento do pensamento se propicia em um ambiente social onde a educadora joga um papel importante contribuindo à interação

interacción de los niños haciendo uso de la comunicación efectiva y apoyo mutuo.

dos meninos fazendo uso da comunicação efetiva e apoio mútuo.

Keywords: Learning, attention, understanding, logical, motivation, thinking, problems.

Palabras clave: Aprendizaje, atención, comprensión, lógico, motivación, pensamiento, problemas.

Palavras chave: Aprendizado, atenção, compreensão, lógico, motivação, pensamento, problemas.

PARA CITAR ESTE ARTÍCULO / TO CITE THIS ARTICLE / PARA CITAR ESTE ARTIGO:
León Urquijo, A.P., Casas Antilef J.C. y Restrepo Ramírez, G. (2016). Desarrollo del pensamiento lógico basado en resolución de problemas en niños de 4 a 5 años, *Panorama 10 (19),* 98-107.

INTRODUCTION

Humans give progressive signals of the development of logical thinking from the earliest age. Gelman and Gallistel (1978), based on various studies, proved that children develop abilities that allow them to access the numerical knowledge that will direct them learn mathematical abilities. In other words, when they arrive at the kindergarten, children carry with them a series of mathematical skills that allow them to develop in a concrete way, solving situations in which they logically demonstrate the capabilities they have acquired in the natural environments of school, family and social nuclei; but, with the help of educators they expand, develop, foster new knowledge and strengthen the one they already have acquired.

The development of logical thinking occupies an important place in children's evolutionary process, because it involves processes of observation, interpretation, analysis, motivation and comprehending of relationships, and this manifests several metacognitive principles. The research results that will be presented herein, were the result of an Educational Sciences Masters in the University of Los Lagos. The purpose of this study was to describe the process children from 4 to 5 years old use to solve mathematical problems during a mathematical logic and quantification program, that includes a problem solving didactic strategy based on play, (as a partial result of the project "*Discourses and practices of preschool and first year teachers: a comparative study between Quebec-Chile-Colombia*"[1]), which allowed us to know how children handle themselves when faced with to different aspects and problems of daily life. This research also inquires into finding the most appropriate solution to a problem, or simply if they opt to choose the most recurrent strategy, considering the educator's relationship with the children, their environment's stimuli and previous learning.

METHODOLOGY

For this research, we selected an intentional sample of 20 children aged 4 to 5 years, from a state nursery school in Osorno, Chile. Authorization and informed consent was requested from the educational institution and the parents or guardians informed agreement so the children could participate this study. The research's focus was mixed (qualitative and quantitative) of descriptive scope, with a longitudinal methodological panel design (Hernández, Fernández and Baptista, 2010), in order to collect and describe the necessary details of play and task situations, interactions between children and with adults and reactions to problems presented during the games. They were recorded during the 2013 -2014 school year.

The instrument was constructed taking the items (attention, comprehension, motivation, information processing, ways of solving-metacognition, ways of solving-reasoning and information output) from "*Scale for Observing Problem Solving Strategies* ", Sáiz and Román (2011). This article presents the results of the first three items corresponding to attention, comprehension and motivation with their respective indicators.

[1] Their project began in 2013 and ended in 2015, led by a PhD. Michèle Venet of the University of Sherbrooke (Canada), jointly developed with the University of Los Lagos (Chile) and Technological University of Pereira (Colombia).

The diagnosis was compared with the final assessment, by means of comparing the arithmetic median with the Student's T test, the probability or significance is represented by $\alpha = 0.05$, with the following statistical formula:

$$s_x = \sqrt{\frac{\sum (x_i - \bar{x})^2 \cdot n_i}{n}} = \sqrt{\frac{\sum x_i^2 \cdot n_i}{n} - \bar{x}^2}$$

The results are presented in tables, and were obtained by running the information in the SPSS version 20 (IBM Corporation, 2011) statistical software, which represents frequency F, diagnosis D, final assessment E f, mean M, number of children N, typical deviation D tip. and bilateral significance Sig. (b). The information analysis was complemented with audio and video recordings, which reflect the behavior's descriptive elements (verbal and non-verbal evidence), just as the problem solving processes occurred in the interactions that children had with the learning processes.

ANALYSIS AND DISCUSSION OF THE RESULTS OF THE LOGICAL THINKING DEVELOPMENTAL PROCESS BASED ON PROBLEM RESOLUTIONS

At the beginning of the educational intervention based on mathematical games (Gilb, 2003) directed to every day practical activities, the children tended to ask on various occasions about the game's rules and it had to be modeled several times in a concrete way, so that they could comprehend. The educational program's games were performed and repeated on various occasions, and we observed when problem solving strategies used were changed.

ATTENTION

Table 1

Looks at the educator when he/she asks for information			***Looks at the educator when he/she proposes an activity***		***Follows orders or instructions***	
	D	**E f**	**D**	**E f**	**D**	**E f**
	F	F	F	F	F	F
Never	0	0	0	0	0	0
Almost never	1	0	0	0	0	0
Sometimes	5	1	6	1	8	1
Almost always	8	8	8	6	5	9
Always	6	11	6	13	7	10
Total	20	20	20	20	20	20

Source: Author's own elaboration

Table 2

T Student Test *Statistics of related samples*	***M***	***N***	***D typ.***	***Sig. (b).***
Looks at the educator when he/she asks for information	3.95	20	0.887	0.00
	4.50	20	0.607	
Looks at the educator when he/she proposes an activity	4.00	20	0.79	0.00
	4.60	20	0.59	
Follows orders or instructions	3.95	20	0.88	0.00
	4.45	20	0.60	

Source: Author's own elaboration

As for attention in the T test (table 2), the level of significance is lower to α = 0.05 (0.00 <0.05) in the indicators "*look at the educator when he/she asks for information", "look to the educator when he/she proposes an activity* "and" *follows orders or instructions* ", which indicates that there are significant differences between the diagnosis and final assessment.

In the first indicator always "*looks at the educator when he/she asks for information* ", went from 6 to 11 children, almost always remained at 8, sometimes went from 5 to 1 and almost never went from 1 to none (table 1). This indicates that visual contact and interaction generated between the educator and the child will be influential because educators are role models for the children, but most of their learning is obtained through observation, so to the extent that the models are strategic the child when faced with the task, play or activity, will do so in a similar way, think when acting, plan or evidence their self-regulation mechanisms (Thornton, 2000).

In the second indicator "*looks at the educator when he/she proposes an activity* " always went from 6 to 13 children, almost always decreased from 8 to 6 and sometimes from 6 to 1 (Table 1), this shows the importance of using of didactic strategies and performing an activity to motivate children's attention, thus developing the ability of learning how to learn and this also permits specifying the processes that facilitate the children's autonomy and control in relation to the own learning (Lacasa and Herranz, 1995). For example, in the game " *Sleepy Juanito* ", children were invited to imagine that they were in a field tending sheep; for this they were told the story of sleepy Juanito, who did not realize that his sheep disappeared when he fell asleep; then a volunteer was asked to role play as Juanito, he was asked to observe and guard the herd, but he fell asleep (he was asked to leave the classroom), and upon awakening, sometimes sheep went missing or appeared when Juanito entered the classroom and checked all the animals... and the game was played until all the children fulfilled the role of sleepy Juanito. In face of this experience, the eyes of the children were centered on the educator and the flock of sheep; although not all achieved the objective of giving their answers, their concentration and attention was captured during the game.

These results confirm the importance of motivating attention: the relationship of children with the educator favors attention, since trust, good treatment and proper guidance led to the development of problem solving processes that flowed naturally by means of children's games.

In the third indicator "*follows orders or instructions,* " 7 always increased to 10 children, almost always

increased from 5 to 9 and sometimes decreased from 8 to 1 (Table 1). These results show that, in thought's developmental processes, "the child is creating and maturing the structures of logical-mathematical reasoning thanks to constant interactions with people and the environment that surrounds him ″ (Alsina, 2006, p. 27), that is, in order to perform a game or an activity they must follow step by step orders in order to achieve the objective and the starting point for educational work (Gilb, 2003). Attention improved through different games that allowed an improved comprehension and development of logical thinking.

When playing active games like "Splash the Lizard", before starting to play, they were presented with the game's rules, and then they were asked to make a circle by choosing a volunteer to be "Splash the Lizard". The volunteer had the job of catching mischievous little monkeys when the song ended, but could not catch the little monkeys that were hiding behind trees, who were impersonated by children volunteers. Once he caught all the loose monkeys he counted them and wrote the number in the board. For the game to be successful the children followed orders. The first time they played the game, the children were very enthusiastic, even though they had to follow the orders, since everyone wanted to run and be caught; although all correctly counted the number of monkeys caught, only 4 children counted one by one and associated them with the corresponding total number. The second time they played they clearly comprehended the rules, so the game was successful, thereby increasing to 6 children the ones who associated the number-amount. Afterwards, when the game was repeated, the amount of children who could follow the rules and count the children caught one by one increased.

The learning processes, depending on how they are addressed, require processes such as attention, storage and memory, the cognitive paradigm defined as guided learning. The constructionist paradigm posits it as a mediator or constructive process, which includes assessment, transfer, among others.

Monereo and Castelló (1997), establish that strategies are "decision-making processes that are consciously carried out in order to achieve an objective, in which they activate techniques and procedures of a different nature (disciplinary and interdisciplinary)" (p. 78). It is thus that attention is a cognitive function that matures throughout development, as well as impulse control that involves the mechanisms of selection, distribution and the maintenance of psychological activity (León, Jiménez and Restrepo, 2010), through strategies where planning, reflection and assessment are required. Through these processes some children were able to recover strategies that served them in other situations and to know what procedure they used depending on the tasks, either to repeat actions, situations or to solve problems.

COMPREHENSION

(T3) Table 3

Comprehends the proposed tasks			Has problems comprehending the used terms		Although he/she does not comprehend a task verbally, he/she does so when the teacher gives a demonstration.	
	D	E f	D	E f	D	E f
	F	F	F	F	F	F
Never	0	0	0	1	1	0
Almost never	1	0	7	12	5	5
Sometimes	9	2	10	7	4	0
Almost always	5	10	3	0	8	9
Always	5	8	0	0	2	6
Total	20	20	20	20	20	20

Source: Author's own elaboration

Table 4

***T Student Test* Statistics of related samples**	***M***	***N***	***Type D***	***Sig. (b).***
Comprehends the proposed tasks	3.70	20	0.92	0.00
	4.30	20	0.66	
Has problems comprehending the used terms	2.800	20	0.70	0.014
	2.30	20	0.57	
Although he/she does not comprehend a task verbally, he/she does so when the teacher gives a demonstration.	3.25	20	1.11	0.086
	3.80	20	1.15	

Source: Author's own elaboration

The results of the T test (Table 4), the significance level is lower than α = 0.05 (0.00 <0.05 and 0.014 <0.05) in the first two indicators "*comprehends the proposed tasks*" and "*has problems comprehending the terms used*" respectively, there is a significant difference between the diagnosis and the final assessment. In the indicator "*Although he/she does not comprehend a task verbally, he/she does so when the teacher gives a demonstration,*" the level of significance is greater than α = 0.05 (0.086> to 0.05), which indicates that there is no significant difference between the diagnosis and final assessment.

In the first indicator "*comprehends the proposed tasks*," the indicator always increased to 8 children, almost always increased from 5 to 10, and sometimes decreased from 9 to 2 (table 3), because they were in the state of elaborating the knowledge of the proposed situations. The learning and development of possibilities depend on the zone of proximal development (ZPD), and the stimulus to reach the area of potential development, that create spaces that generate educational interaction, making task awareness enable the children to use more or less cognitive or metacognitive strategies (Lacasa and Villuendas, 1988).

When the game "*Dunk the Cards*" was *played*, the children had to dunk cards into different boxes; to do this four teams had a color each (yellow, red, blue and green). Each team sat in rows and demarcated a line on the ground where they had to stand when throwing. Each child had three letters. The educator told them that when everyone had finished throwing their cards into the basket, the first child in each row had to count how many cards his team scored, the amount would be written by her on the board, and then they were asked what team had dunked the most cards. The same game was played but teams were changed and the results of the previous game were added; the educator, together with the children, decided which group had dunked the most cards. In addition, they were asked why did the highest amount win; a child responded with "*because there are more,*" the educator asks, " *why are there more*?" and then came the answer "*because it is a large number* (9) *and there are nine letters in the box*". In this way we can understand that mathematical activity is based on the recognition of early numerical competences, on representations, procedures and on the progressive increase of comprehension (Orozco and Otálora, 2003).

In this game, most children correctly received the rules; those who did not comprehend were explained in a more personalized way, but as the children participated they understood the game better. When counting the cards, they all enunciated the amount and because they were low amounts, only three children were helped. When each group's cards were added, only three children matched the correct amount for all groups, four matched only the small amounts, and the rest of the children imitated their answers by making them known by word of mouth. Then they were asked again, what team won? And everyone answered "the one *who has 9*" and they were asked why, and one child answered with "*because there are many*," another child confirmed this answer.

To ensure that the children were able to know what knowledge they needed in order to make the game or task easier, they had to resort to different problem-solving strategies, because "It is important to consider 'error analysis' as a relevant element (Sáiz, 2000); because studying where the fault lies,

can redirect the resolution towards a correct process thereby facilitating the construction of knowledge" (Sáiz and Roman, 2011, p.11).

In the indicator *"has problems comprehending the used terms,"* the category never passed from 0 to 1 for those that had difficulties in comprehending the terms; almost never increased from 7 to 12; sometimes decreased from 10 to 7 (Table 3). Whenever children presented comprehension problems in games or activities, they were given the opportunity to express their difficulties. In relation to this, Orozco and Otálora (2003) affirm that children should be encouraged to confront, evaluate and give feedback about their knowledge, and this allows them to construct more sophisticated procedures and concepts with higher levels of abstraction.

The children who had trouble comprehending manifested many times a difficulty in solving problems; according to Thornton (2000), this may be because they had limited previous knowledge about the tasks, activities or games that they faced.

In this study, children began working with the "Playing with Mathematics" educational program from April, which undoubtedly reflected the increased information they had about problem-solving and logical thinking, if we observe each's individuality, because the knowledge they acquired was growing at their own pace.

In the indicator "*Although he/she does not comprehend a task verbally, he/she does so when the teacher gives a demonstration,*" changes between the diagnosis and the final assessment were few, always passed from 2 to 6 children, almost always passed from 8 to 9, it almost never remained 5 and never went below 1.

Although six children were able to perform abstract tasks, such as solving verbal problems in which they were invited to concentrate and listen very carefully to questions, they were previously told that only the child that raised his/her hand could answer: the questions were as follows: - How *many legs do 2 lions have*? How *many ears do 3 rabbits have*? How *many wheels do 2 cars have*? How *many hands do 2 children have*? How *many legs do 3 lions have*?

In this experience, the first thing the children began to do, was to guess the amount by enunciating random numbers, but four children in particular were observed to be thinking and analyzing the question; three of them arrived at the solution by counting their fingers or with their fingers, one by one, imagining the rabbit ears, stating 5 as the answer, then saying - "*no, no*..." they counted their fingers again and said 6, thus arriving at the right answer; the rest of the children who arrived at the answer did so by counting their fingers in imitation of their peers. The question "how many wheels do 2 cars have?" was solved only by one child: he crouched and looked under the tables, then said "they *have 8 wheels* "; when asked why he knew, said: "As *a car has 4 wheels and the table 4 legs, two tables have 8 legs and two cars have 8 wheels*".

The educator is a mediator, he/she must always provide the necessary aid and adjust it when the children need it, since sometimes an improper intervention can inhibit the use of strategies and the accomplishment of tasks, games or activities (Thornton, 2000).

When the questions and answers round was finalized, the answers were jointly reviewed and the results were verified in a concrete way, it was

noticeable that the children who could not perform it abstractly through questions, comprehended it when it was performed concretely or after modeling each activity.

Within problem solving there are verbal utterance problems, which require analyzing this unknown, because they can rely on too many or few data, and can be solved in more than one way. "Problems of non-verbal utterance are the problems which mainly rely on the image: visual problems and sequence problems "(Alsina, 2006, p. 142). Children often present difficulties in dealing with problems and this may be due their lack of previous knowledge about the tasks, activities and problems they are facing.

There are other factors such as the ability of children "to make correct inferences from their own representation of the problem and the difficulty to properly learn the required information that directly influences the attempt to find the right solution "(Thornton 2000, p. 80), so that problem-solving skills are dependent on increasing the information that children possess, because the knowledge they acquire, at their own pace and their skills, will help them comprehend the procedures involved in metacognitive processes inherent in the development of logical thinking.

MOTIVATION

Table 5

Has an interest in the proposed tasks			*The interest depends on the type of task*	
	D	**E f**	**D**	**E f**
	F	F	F	F
Never	0	0	1	2
Almost never	0	0	7	7
Sometimes	6	2	8	9
Almost always	8	6	4	1
Always	6	12	0	1
Total	20	20	20	20

Source: Author's own elaboration

Table 6

T Student Test Statistics of related samples	*M*	*N*	*D Type.*	*Sig. (b)*
Has an interest in the proposed tasks	4,00	20	0,79	0,002
	4,50	20	0,68	
The interest depends on the type of task	2,75	20	0,85	0,419
	2,60	20	0,94	

Source: Author's own elaboration

In the motivation item for the first indicator "Has an interest in the proposed tasks", the results of the T test (Table 6), the level of significance is lower than α = 0.05 (0.002 <0.05), there is a significant difference between the diagnosis and the final assessment, since the children who showed interest always increased from 6 to 12, almost always decreased from 8 to 6, and sometimes from 6 to 2 (Table 5). Although the interest of the children in performing activities or games was increasing, since each time they understood better, besides having a desire to do well or win, they were also improving their skills; In addition, the complexity of the games continuously created new challenges, because when the tasks became too easy the children lost interest in them (Thornton, 2000). They showed more interest and persistence when they put together a "Puzzle of a Square", consisting of five pieces of paper, and they glued them together when they finished. They were given verbal support and motivation to try as often as necessary, children were observed trying to fit the polygons again and again without being able to fit them, they asked for help or said they could not do it, arguing that it was very difficult; 10 minutes after the activity started, a girl succeeded, two minutes later a child did it with a little help from the teacher, as one piece was upside down, and of the 18 remaining children only 2 acquired the competence. In the final assessment that required putting together the puzzle of a triangle, 20 children achieved it in 7 minutes, the others kept trying without losing their motivation until they achieved it in longer time.

Knowledge of the task allowed the children to use some cognitive and/or metacognitive strategies in solving problems; these strategies were adequate to achieve the desired goals, since in this way they became aware of the best resolution strategies for each situation that they faced.

Problem-solving plays a very important role in motivating the development of logical thinking, since it is present at all times, whether in games, in the social world or in daily work. Human beings, at any stage of their life, have the possibility of solving problems (Thornton, 2000). As the children had more information and experiences they were able to acquire more problem solving strategies.

Experience plays an important role in the problem-solving process; so that two children who used the same process to solve a problem could reach different conclusions, depending on the experience of each one. To this we add, that experience delivered more information and the richer it is, the easier it will be for the child to tackle a problem (Thornton, 2000).

> It is also important to keep in mind that although children achieved expertise in some tasks, this was not a condition in others, since the processes are not generalized to all areas. Another element that played an important role was how they faced tasks, since a concept of self is influential, linked to social experience and the position it occupies within the environment (Thornton, 2000).

In this sense, interaction with the educator became an important influence, since he/she acted as a role model for the children. While it is true that children not only learned from their role models, much of their learning was obtained from observation and imitation, so, as long as it was strategic, when the educator thought in order to act, planned or demonstrated self-regulatory mechanisms, the children did so in a similar way when faced with tasks or problems. When the educator interacted with the children he/she was

also a mediator, always providing necessary help and adjusting it when they required it.

For the indicative "*Interest depends on the type of task* ", the results of the T test (Table 6) were of a level of significance higher than $\alpha = 0.05$ (0.419> 0.05), there is no significant difference between the diagnosis and the final assessment, since on this occasion interest in the task was almost the same as when developing interaction spaces and in the two assessment moments (Table 5), in addition the methodology focused on the game -that is not only about having fun but of learning- (Ferrero, 2004), the game was great didactic strategy for children and to develop interest in activities and/or tasks, since the materials enable interaction through puzzles, rounds, songs, bingos, labyrinths, among others, and capture the children's attention and interest. It also stimulated thought development through practical and entertaining applications. Therefore, children almost never lost interest in participating in a concrete or abstract way, thus generating in them a beginning for mathematical learning.

Above all, mathematical activity must be based on the recognition of early numerical competences, both at the level of its representations and procedures and in the progressive increase of comprehension. If teachers are aware of the range of skills that a child possesses before the age of 6, the age on which he or she begins primary education, they may take advantage of said skills in order to begin their transformation into proper mathematical knowledge (Orozco and Otálora, 2003, p. 202).

In the classroom, the resolution of mathematical problems that involved the educator, allowed maintaining the children's interest in face of problematic situations, through motivating activities serving the desired tasks contents.

It was important to give the children the opportunity to express themselves and to reveal their competences when faced with problematic situations. According to Monereo (2007), it is possible to inculcate autonomy in children through permitting them the possibility of self-regulating their own learning, thanks to others' mediation, thus generating greater results in order to achieve the purpose of educating children to use problem-solving strategies. "The methods that are based on thinking out-loud and the gradual transfer of the decisions that must be taken in problem resolutions, have been especially beneficial" (page 505).

Children consciously thought when they were explained the meanings of the problems to be solved and when making decisions about their possible resolution, it was a kind of dialogue with themselves. Thus, when they used a strategy they were aware of their purposes and, when they deviated from them, they were able to reorient or regulate their actions (Monereo, Castelló, Clariana, Palma and López, 2007).

Faced with this, it was necessary to promote several phases for the development of problem solving skills. The first is the diagnosis, establishing the knowledge-skills stage the children were at the time of the study. This obtained a previous analysis and a starting point for the intervention. In this phase "the child is intended to confront, evaluate and feedback his knowledge, thus constructing more sophisticated procedures and concepts with higher levels of abstraction" (Orozco and Otálora

2003, p. 205). In the monitoring phase, which incorporated the two phases that demonstrated the continuity in time mentioned above, allowed the educator to follow the learning processes that the children were developing, being able to verify any advances or setbacks. This is the educator's role as a mediator, since, by carefully observing the children's problems solving processes, their interaction was necessary for experience sharing.

Thus any problem solving success depended on the types of inferences that the children were able to perform, the aspects that they managed to extract from tasks, games, experiments, among others, recognizing and comprehending with the help of game strategies and trial and error that eased the resolution of problems as they acquired experiences and knowledge pertaining the problems.

CONCLUSIONS

In this study, attention was found to be the most appreciated by children due to their relationship with the educator. Treating them with trust, correct and well-directed instructions, use of appropriate language and appropriate guidance, lead to greater progress in problem solving.

The children's interest in the tasks also improved significantly, since the interest and motivational didactic strategies, besides being attractive, also allowed them to concentrate more.

In terms of explaining verbally whether tasks were easy or difficult, it is important to note that the principles related to learning and the developmental thinking process through problem solving in early childhood - not forgetting that children have the capacity to solve problems - were developed over time with the acquisition of new experiences and learning; these were polished by means of important role models found in their families, social and school contexts. Thus, they demonstrated skill when they solved verbal utterance problems, understood the tasks to be performed; and when the answers were erroneous, they sought alternatives by evaluating their procedure through reasoning.

These past experiences in solving the problems related to daily tasks, such as how many tires do two cars have, with the use of language, allowed them to make number-quantity associations in a fun way through continuous games. Thus acquiring skills and cognitive abilities alongside the expertise they have been gaining in their lives.

This group of children has much improved in comprehending the problems to be solved. It is important to note that for children who improved their problem solving skills, this contributed to the development of logical thinking, not only through the learning of various strategies, but by learning to be aware of how to solve situations and how this will be important for their cognitive development; in the same way, they were able to recognize that a situation has certain characteristics and steps to follow in order to achieve the competences that they were able to use in order to partially or totally solve other problems, and they understood that other problems required different types of strategies. It seems very complex if described in this way, but children at this stage of their intuitive thinking development, acquire the logical functions of thinking through the interaction with objects, with specific purposes that promoted mental agility in order to find solutions to other problems that

appear in the school environment and in everyday life.

Solving a new problem was a stimulating intellectual task for children, as it prompted them to reflect by developing the ability to think, valuing their own learning processes, discovering new concepts and inventing new strategies to solve their problems. This resulted in children being more aware of their possibilities and with better cognitive development that stimulated them to think, experiment and self-regulate.

On the other hand, the educator was a facilitator of the game strategies that the children needed to find the solutions that would lead them to solve problems. It was important to clearly communicate the task or activity's instructions and avoid, as far as possible, immediate solutions; rather, guide the children towards experimentation and put into practice the solution to the problem. The idea was that they needed to have the opportunity to demonstrate their capacity for reflection and to find their own strategies for solving the problem, thus expanding their thinking capabilities and above all their capability of seeking and choosing the way solve the problem. And when they found the solution they felt the satisfaction for having done so.

The correct solution to the problems depends on the concrete experience and familiarity with the task, the later increases the reasoning capacity, since children draw on their previous knowledge of their real world and are able to extrapolate those findings to new situations.

The game was undoubtedly the best ally as a problem solving didactic strategy, since children learned from an action proper to their infantile condition and in a fun way - which is often lost through educational evolution, considering it to lacking seriousness- , but the educator made good use of it, and obtained lasting teachings that generated other teachings, within the endless chain of the development of logical thinking.
Through the motivation and the satisfaction of achievements in problem solving, the children were stimulated to persevere in new tasks, thereby preparing the development of logical thinking for a later school stage, where they will have to learn mathematics that traditionally has been the area of greatest difficulty, due more to a social condition, not because it really is.

Children of 4 to 5 years not only solved problems in action, they also did it by means of the abstraction, because they are able to give an answer in oral form, that they have elaborated from their thoughts about the posited situations, where they had to make use of previous lessons learned concretely.

Through the instruments used in this study, by comparing and analyzing the field notes, it was possible to find that some children are more resourceful in problem solving with instructions; the most usual thing was to ask for help, the instructions were repeated and they were given support stimuli that helped them to achieve the goal, sometimes by themselves according to their perceptions and abilities, and observing how other children interacted and helped each other. This reaffirmed that the development of the thought was propitiated in a social environment, in the interaction with others and by making use of communication and mutual support.

REFERENCES

1. Alsina, Á. (2006). Cómo desarrollar el pensamiento
2. matemático de 0 a 6 años. Barcelona: Editorial
3. Octaedro.
4. 2. Ferrero, L. (2004). El juego y la matemática.
5. Madrid: Editorial La Muralla, S.A.
6. 3. Gelman, R. y Gallistel, C. R. (1978). The Child's
7. understanding number. Cambridge: Harvard
8. University Press.
9. 4. Gilb, S. (2003). Juegos para escolares. México:
10. Editorial Pax México. S. A.
11. 5. Hernández, R. Fernández, C. y Baptista, P.
12. (2010). Metodología de la investigación. México,
13. D.F: Editorial Mc Graw-Hill.
14. 6. IBM Corporation. (2011). Guía breve de
15. IBM SPSS Statistics 20. New York: Editorial
16. Copyright IBM.
17. 7. Lacasa, P. y Herranz, P. (1995). Aprendiendo a
18. aprender. Resolver problemas entre iguales. Madrid:
19. Publicaciones del Ministerio de Educación y
20. Ciencia, España.
21. 8. Lacasa, P. y Villuendas, D. (1988). Acción y representación
22. en el niño: interacción social y aprendizaje.
23. Madrid: Ministerio de Educación y Ciencia
24. CIDE.
25. 9. León U., A. P., Jiménez R. A. Ma. y Restrepo R.,
26. G. (2010). El trastorno por déficit de atención
27. en el sector educativo oficial de Armenia. Revista
28. UQ. 9(5), 1-20. Recuperado de: file:///C:/Users/
29. aleon/Downloads/Dialnet-ElTrastornoPorDefi
30. citDeAtencionEnElSectorEducativo-3629335.
31. pdf
32. 10. Monereo, C. (2007). Hacia un nuevo paradigma
33. del aprendizaje estratégico: el papel de la mediación
34. social, del self y de las emociones. Revista
35. Electrónica de Investigación Psicoeducativa, 5(3),
36. 497-534.Recuperado el 23-06-2013 de: http://
37. www.investigacion-psicopedagogica.org/revista/
38. articulos/13/espannol/Art_13_206.pdf
39. 11. Monereo, C. y Castelló, M. (1997). Las estrategias
40. de aprendizaje. Barcelona: Editorial Edebé.
41. 12. Monereo, C. (coord.). Castelló, M., Clariana,
42. M., C., Palma, M., y López, Ma. L. (2007).
43. Estrategias de enseñanza y aprendizaje. Formación
44. del profesorado y aplicación en la escuela. Barcelona:
45. Editorial Graó.
46. 13. Orozco, M. y Otálora, Y. (2003). Las competencias
47. matemáticas de los niños pequeños. Artes gráficas
48. del Valle Editores-impresores Ltda.
49. 14. Sáiz, Ma. (2000). Entrenamiento metacognitivo

50. en el aula. Un procedimiento curricularmente
51. integrado, en J. N. García S. (coord.) (2000). De
52. la psicología de la instrucción a las necesidades curriculares.
53. Andalucía: Oikos-Tau S. A., 53-64.
54. 15. Sáiz, M. y Román, J. (2011). Entrenamiento
55. metacognitivo y estrategias de resolución de
56. problemas en niños de 5 a 7 años. International
57. Journal of Psychological Research, 4(2), 9 - 19.
58. 16. Thornton, S. (2000). La resolución infantil de
59. problemas. España: Editorial Morata.